9. (14 points) On the day after Thanksgiving, the stores were mobbed with shoppers. In the local ToysWereU Store there were already 50 people in line when the security guards showed up at 6:50 a.m. The graph above shows the rate, \( R \), in arrivals/minute at which people arrived after 6:50.

The store opens at 7:00 a.m., and the guards are to allow people into the store at a constant rate of 20 people per minute. Use this information and the graph to estimate the following:

(a) The length of the line (i.e. the number of people) at 7:00 when the guards begin letting people into the store.

\[
50 + 200 \approx 250 \text{ people}
\]

(b) The length of the line at 7:20.

\[
\frac{250}{7:00} + \int_{7:00}^{7:20} R(t) \, dt - 400 \approx \frac{250}{7:00} + \frac{50}{0.1} \approx 350 \text{ people}
\]

(c) The rate at which the line is growing at 7:10.

\[
\frac{27}{min} - \frac{20}{min} \approx \frac{7}{min}
\]

(d) The length of time a person who arrives at 7:00 has to stand in line.

\[
\frac{250}{20} \approx 13.5 \text{ minutes}
\]

(e) The time at which the line disappears.

\[
\text{By 7:10, } \approx 900 \text{ ppl have arrived (including the original 50). 800 have been let into the store. The line is decreasing at } \approx 15 \text{ ppl/min } \Rightarrow 800 \text{ ppl at } 7:10 \Rightarrow \text{line should disappear.}
\]